TITLE: Relationships between CO_2 soil degassing and regional/local fault systems in the Kiejo-Mbaka geothermal prospect (Tanzania)

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The Kiejo-Mbaka geothermal prospect in the Mbeya region of SW Tanzania was surveyed for geothermal exploration in a recent study co-financed by the Ministry for Foreign Affairs in Iceland and by the Nordic Development Fund (NDF) and implemented by the Tanzania Geothermal Development Company Limited (TGDC). A multidisciplinary approach was adopted, including geological, geochemical and geophysical surveys. The prospect falls within the southern sector of the Rungwe Volcanic Province (RVP), which is situated at the triple junction of the Rukwa, Usangu and Karonga basins of the East Africa Rift System. Recent volcanism is concentrated in the northern sector of the RVP, whereas recent eruptions were sustained by small magma batches derived from deep sources in the prospect area. Local stratigraphy is mainly characterized by Pre-Cambrian rocks of the metamorphic-intrusive complex covered by Pleistocene volcanic products (basalts and ignimbrites) with a thickness never exceeding 200 m. Several fault systems are present, among which the most important ones trend NW-SE and N-S. The main tectonic feature is the NW-SE-trending Mbaka fault, which controls the local emergence of hot waters at Ilwalilo and Kilambo-Kajala (maximum discharge temperature of 64°C), delimits to the W the Mbaka ridge, and is associated with a series of parallel structures extending in the plain. Both the gravimetric and the electromagnetic surveys concur in identifying the existence of a block corresponding to the above mentioned Mbaka ridge and characterized by a pronounced positive Bouguer anomaly and by high resistivity, due to the proximity of basement rocks. At Kiejo, Ikama, and Lufundo there are gas vents emitting CO_2-rich gases, which are captured by drilled wells in the first two sites.
Since the Kiejo-Mbaka prospect is classified as an extensional domain, in which flow-paths of geothermal fluids are fault-controlled, part of the geochemical survey was addressed to identify and define the relationships between fluid flow and structures at local scale, in selected hydrothermal areas including Kilambo-Kajala, Ilwalilo and Kiejo. Taking into account the regional fault distribution and preliminary results obtained during the field surveys, also others areas were included in the investigation (i.e. Lufundo, Itende and Kikusya). A total of 598 soil CO2 flux and temperature measurements (~1 m depth) were carried out. Total output was estimated and isoflux maps were elaborated for each investigated sector. In general, CO2 fluxes appear to be controlled by NW-SE and N-S trending faults and fractures. The former prevails at Kiejo, Kilambo-Kajala and Ilwalilo, which is not surprising for Kilambo-Kajala and Ilwalilo, since the hot springs are positioned along the Mbaka fault. In contrast, the N-S trend dominates at Lufundo.